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भारतीय मानक

ग्रेडर — नींबू प्रजाति — आकार आधारित

Indian Standard

GRADER — CITRUS — SIZE BASED

ICS 67.060

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

February 2009

Price Group 1

Agriculture and Food Processing Equipments Sectional Committee, FAD 20

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Agriculture and Food Processing Equipments Sectional Committee had been approved by the Food and Agriculture Division Council.

Citrus occupies third position after mango and banana in the production of fruits in India. Citrus fruits originated in the tropical and sub-tropical regions of South East Asia , particularly India and China. North East India is the native place of many citrus species. It is of particular interest because of its high content of vitamin C and refreshing juice. Of the various types of citrus fruits grown in India, orange (mandarin or santra), sweet orange (mosambi, malta or satgudi) and lime/lemon are of commercial importance. Lime or acid lime is also commercially known as 'Pati lime' or 'Kagzi lime'. Sweet orange is commercially important for production of palatable juice.

One of the post-harvest operations for which citrus growers and cold storage owners are presently facing hardships is the separation of citrus into different size grades. This is known as 'grading'. Grading helps the farmers in getting higher profit for their produce when sold in the market. Citrus graders are used for separation of potatoes into different size grades. Different types of potatoes graders have been developed and are being manufactured in the country. However, there was no test code to evaluate the performance of these machines. Therefore a need was felt to formulate this standard in order to have a uniform test procedure for citrus graders.

In the formulation of this standard, considerable assistance have been derived from Indian Agriculture Research Institute, Pusa, New Delhi.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 :1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

GRADER — CITRUS — SIZE BASED

1 SCOPE

This standard specifies requirement of power operated citrus grader for grading citrus, namely, Kinnow Mandarin, Nagpur oranges and sweet oranges based on their sizes (the smallest diameter).

2 REFERENCES

The following standards contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	*Title*
816 : 1969	Code of practice for use of metal arc welding for general construction in mild steel (*first revision*)
1030 : 1989	Carbon steel castings for general engineering purposes (*fifth revision*)
1875 : 1992	Carbon steel billets, blooms, slabs and bars for forgings (*fifth revision*)
2062 : 2006	Hot rolled low, medium and high tensile structural steel (*sixth revision*)
4432 : 1988	Case hardening steels (*first revision*)
6911 : 1972	Stainless steel plate, sheet and strip — Specification (*first revision*)

3 TERMINOLOGY

For the purpose of this standard, the following definitions shall apply.

3.1 Frame — The part which supports the machine.

3.2 Dimension — Overall size of the machine.

The citrus size based grader will be working as expanding opening endless conveyor belt grader. The conveyor belt will be inclined along the width. So that as soon as matching opening is available, the fruit will be dropped out, till then fruit will be carried by the belt.

4 MATERIAL

The list of various components, their material of construction and relevant standards are given in Table 1.

Table 1 Components and Their Material of Construction
(*Clause* 4)

Sl No. (1)	Characteristic (2)	Material (3)	Ref to Indian Standard (4)
i)	Frame	Mild steel angle iron	2062
ii)	Feeding/Discharge chute	Mild steel sheet, 16 gauge	6911
iii)	Rubber lining on all chutes and contact places	Soft rubber, 3 mm thick	—
iv)	Pulley/Gears	Cast steel	1030
		Case hardening steel	4432
		Forged steel	1875
v)	Shaft	Mild steel	2062

5 DESIGN

The expanding opening endless conveyor belt grader has following main components:

a) Heading chute,
b) Endless conveyor belt,
c) Expanding opening rollers,
d) Discharge chute,
e) Power transmission system, and
f) Frame.

5.1 Feeding Chute

It is made of polished mild steel sheet 16 gauge, inclined towards the feed end of the endless by conveyer by 10° angle from horizontal. The drop between chute and belt limited to 30 to 40 mm. The complete top surface of the chute is lined by soft rubber.

5.2 Endless Conveyor Belt

An endless conveyor belt (120 to 125 mm wide) moving on rollers is fitted. The axis of the rollers is inclined about 15 to 25° with the horizontal, to enable the fruit to slide in the opening wherever it fits during movement on the belt. The linear speed of the belt will decide the capacity of the machine. It is product of number of fruits per unit length, average weight of fruit (kg) and linear speed of the belt (unit length/h). The minimum distance between the rollers should be 2 m to separate the fruits in 6 or more grades.

5.3 Expanding Opening Rollers

Moulded smooth plastic rollers are kept along the length of the belt. The distance between the belt and the edge of rollers will be clear space to pass the fruit. The clear fruits will move on the belt taking support of the roller. The clear roller length should be sufficient (minimum 250 mm) so that fruits are dropped in desired discharge chute. Details of different grades of kinnow prevailing is given in Table 2. However, there should be an arrangement to adjust the roller height to increase/decrease the spacing depending on the variety of citrus fruit. Wing nut should be used to adjust the roller clearance.

5.4 Discharge Chute

Fruit passed the clearance between rollers and belt will directly drop on the discharge chute which should be only 50 mm below the belt. The discharge chute inclined to make maximum angle of 25° with the horizontal for smooth discharge. The end of discharge chute should be sufficiently above the ground to enable to keep a plastic crate for direct loading.

5.5 Power Transmission System

The electric motor single phase should be tested as per the Indian Standards. The power is transmitted to the roller either by gears or by V belt. Tension in the V belt should be sufficient to avoid slippage.

Since roller axis and shaft are inclined, the alignment of gears and pulleys should be proper.

Bearings of roller and bushes should be smooth enough so that it do not generate heat and/or the wearing of teethes of worm and belt is not taken place.

5.6 Frame

The frame made of mild steel angle iron should have proper foundation arrangement so that does not provide any vibrations/noise and should ensure the following:

a) Welding used for joining all components should be smooth and as per IS 816,
b) The power transmission system should be full covered by GI sheet, and
c) All corners and projected portions should be smoothen.

6 OTHER REQUIREMENT

Do's and dont's of the grader with the operational manual may be provided.

7 MARKING

7.1 Each machine shall be marked with the following particulars:

a) Manufacturer's name and his recognized trade-mark, if any;
b) Model number; and
c) Batch or Code number or Sl No., if any.

7.2 BIS Certification Marking

Each machine may also be marked with the Standard Mark.

7.2.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

Table 2 Grading of Kinnow Fruit by Mechanical Grader

(*Clause* 5.3)

Sl No.	Grade	Fruits Packed/Box	Mean Size cm			Sphericity	Average Weight of Kinnow (g/fruit)
			D_1	D_2	D_3		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
i)	1	96	6.34	6.24	5.84	0.97	113.67
ii)	2	84	6.88	6.72	6.06	0.95	144.67
iii)	3	72	7.40	7.20	6.06	0.93	158.00
iv)	4	54	8.02	7.90	6.74	0.94	194.00
v)	5	45	8.20	8.05	7.13	0.95	237.67
vi)	6	42	8.38	8.30	7.13	0.95	274.67
vii)	7	30	9.76	9.63	8.20	0.94	324.00

MGIPF—880 Deptt of BIS/2008—30 1 2009—300 Books

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This Indian Standard has been developed from Doc: No. FAD 20 (1751).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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Printed by the Manager, Govt. of India Press, Faridabad